SUPERIORITY OF *APHAENOGASTER OCCIDENTALIS* IN CONFRONTATIONS WITH *SOLENOPSIS INVICTA* (HYMENOPTERA: FORMICIDAE)[1]

Stanley R. Jones, Sherman A. Phillips, Jr.[2]

ABSTRACT: The interspecific confrontational responses of *Aphaenogaster occidentalis* and *Solenopsis invicta* were elucidated by placing individual workers of each species together in petri dishes and observing their behavior continuously for 30 min. Although *S. invicta* was the aggressor, it could not penetrate the cuticle of *A. occidentalis* with its sting. *Aphenogaster occidentalis* was able to apply its venom topically in the majority of these confrontation trials, which resulted in paralysis of *S. invicta* workers within 5 min., and subsequent death within 30 min. These observations represent only the second report in which another species has been successful in confrontational trials with *S. invicta.*

The red imported fire ant, *Solenopsis invicta* Buren, is both an urban and agricultural pest throughout much of the southeastern United States (Lofgren, 1986). This species is aggressive toward other ant species (Jones and Phillips, 1987) and has replaced much of the native ant fauna by direct interference or by competition (Wilson and Brown, 1958; Reagan *et al.,* 1972; Whitcomb *et al.,* 1972; Hung and Vinson, 1978). To date, only *Lasius neoniger* Emery has been shown to be confrontationally superior to *S. invicta* (Bhatkar *et al.,* 1972). Herein, as part of an ongoing larger project to identify potential competitors, we report the successful response of a second ant species, *Aphaenogaster occidentalis* Emery, in confrontational interactions with *S. invicta.*

A colony of *A. occidentalis* was collected from Boulder, Colorado; colonies of *S. invicta* were collected from Kerrville, Texas. The confrontational responses of these species were tested by placing a worker of each species together in 60 by 20 mm petri dishes, the sides of which were coated with Fluon to prevent ant escape. Each of the 25 replications was conducted at 28°C under fluorescent lighting at 70-75% relative humidity. Interspecific interactions of the 8 major, 7 media, and 10 minor workers of *S. invicta* when paired with the monomorphic workers of *A. occidentalis* were observed and recorded continuously for 30 min.

Of the 25 paired trials, 22 (88%) resulted in paralysis of *S. invicta* workers within 5 min. (7 major, 6 media, and 9 minor workers). Only three *S. invicta* individuals recovered within the 30 min. (2 major and 1 media worker). Those individuals not recovering after 30 min. died as a consequence of the venom of *A. occidentalis.* In two of the trials, there was

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[2]Department of Agronomy, Horticulture, and Entomology, Texas Tech University, Lubbock, Texas 79409.

an avoidance of contact, whereas one trial resulted in death of *A. occidentalis* as a consequence of being stung in the area of the hypopharynx by a minor *Solenopsis* worker.

In all trials, *S. invicta* was the aggressor regardless of caste, but in most cases was apparently unable to penetrate the cuticle of *A. occidentalis* with its sting. Although "gaster flagging" has been observed in *S. invicta,* whereby venom droplets are dispersed through the air by raising and vibrating the gaster (Obin and Vander Meer, 1985), this behavior was not observed in these trials. Only after considerable provocation did *A. occidentalis* extrude its sting and topically apply venom to *S. invicta.* The venom droplet was rapidly absorbed through the cuticle by *S. invicta,* causing violent convulsions and shaking in a prone position, with legs outstretched and perpendicular to the body axis. Within 15-45 seconds, the affected *S. invicta* individual curled ventrally with its head near its gaster and remained motionless, with death ensuing shortly thereafter. With one exception, the venom of *S. invicta,* which is topically active against other ants (Schmidt, 1986), had no observable effect on *A. occidentalis.*

Virtually nothing is known about the biology of *A. occidentalis.* Most species of this cosmopolitan genus nest in either the soil, dead branches of trees, or rotting logs (Smith, 1979). Although the venom of *S. invicta* is known to be composed of piperidine alkaloids (Blum *et al.,* 1958; Jouvenaz *et al.,* 1972), attempts to isolate and characterize the venom of *A. occidentalis* have thus far proven unsuccessful (J.O. Schmidt, pers. comm.). However, the poison gland product of *Aphaenogaster fulva* Roger and *A. tennesseensis* (Mayr) is a tobacco alkaloid, anabaseine, and is reported to serve only as an attractant in *A. fulva* (Wheeler *et al.,* 1981). Based on our observations, the poison gland product of *A. occidentalis* serves as a potent and effective toxin for defense and is the first such report for this species and for species in this genus. However, because of the highly efficient recruitment system employed and the relatively large number of workers that typify *S. invicta* colonies, any results obtained from one-on-one interspecific confrontations may not necessarily reflect those that might be obtained from colony-versus-colony confrontations even if the range of these two species overlapped.

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